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Four new records of *Leptogium* from China

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Abstract—Four *Leptogium* species are reported as new to China: *L. askotense*, *L. coralloideum*, *L. milligranum*, and *L. subtile*. Descriptions, illustrations, and comments are presented for the four species.

Key words—*Ascomycota*, *Peltigerales*, *Collemataceae*, lichen, taxonomy

Introduction

Forty-two species of the lichen genus *Leptogium* (Ach.) Gray have been reported from China (Wei 1991; Cao & al. 2012; Liu & al. 2010, 2012, 2013, 2014, 2015; Liu & Guan 2012; Wang & al. 2010; Xi & Liu 2014). Here we report *Leptogium askotense*, *L. coralloideum*, *L. milligranum*, and *L. subtile* as new to China. Although the genus was recently re-circumscribed (Otálora & al. 2014, Jaklitsch & al. 2016), we followed the traditional genus concept (Lumbsch & Huhndorf 2007, Kirk & al. 2008) in the present study.

Materials & methods

Morphological and anatomical studies were conducted following Liu & al. (2015). Specimens are deposited in the Herbarium Mycologicum Academiae Sinicae–Lichenes, Beijing, China (HMAS-L) and the Herbarium, Kunming Institute of Botany, Chinese Academy of Sciences, Kunming, China (KUN).

Taxonomy

Leptogium askotense D.D. Awasthi, Norweg. J. Bot. 24: 63 (1977). Pl. 1a

Thallus foliose, orbicular or irregular in outline, 4–12 cm in diam.; upper surface gray to brown when dry, glabrous, heavily wrinkled, dull or slightly

shiny near margin; LOBES round, 3–10 mm wide, horizontal, entire; ISIDIA and LOBULES absent; LOWER SURFACE paler, densely hairy; HAIRS white, 4–7 µm diam., >100 µm long, composed of a row of cylindrical cells. APOTHECIA abundant, laminal to sometimes submarginal, stalked; DISC red-brown, 2–4 mm in diam., smooth, dull, plane, concave to convex; STALK commonly tubular, not swollen, often with wrinkles and white tomenta; THALLINE MARGIN distinct, concolorous with the thallus, often with tomenta and wrinkles similar to stalk.

THALLUS homoiomerous, 100–250 µm thick; CORTEX on both sides consisting of a single layer of subglobose to irregular, thin-walled cells, 5–10 µm thick; PHOTOBIONT *Nostoc* in chains, 4–7 µm in diam., embedded in a gelatinous layer.

APOTHECIA zeorine, 400–500 µm thick; THALLINE EXCIPLE 100–120 µm thick laterally, with a cortex of a single layer of thin-walled cells; PROPER EXCIPLE euparaplectenchymatous, 50–80 µm thick, consisting of 5–8 layers of subglobose to irregular thin-walled cells; EPIHYMENIUM yellowish, 10–20 µm thick; HYMENIUM 120–150 µm thick; SUBHYMENIUM 40–70 µm thick; ASCI clavate, 8-spored; ASCOSPORES monostichous to distichous, ellipsoid, hyaline, muriform, 5–6-septate transversely, 1–2-septate longitudinally, (15)25–40 × 10–15 µm, obtuse or acute at both ends.

Corticolous.

SELECTED SPECIMENS EXAMINED: **CHINA. SICHUAN PROVINCE**, Mt. Gonggashan, 29°37′N 101°53′E, alt. 2100 m, on bark, 23/VI/1982, X.Y. Wang & al. 8829 (HMAS-L 037125). **YUNNAN PROVINCE**, Lijiang County, Mt. Yulongshan, 27°10′N 100°18′E, alt. 3500 m, on bark, 25/I/2004, L.S. Wang & J. Wang 04-23160 (KUN). **XIZANG PROVINCE**, Zayü County, Mt. Songtaxueshan, 27°43′N 98°39′E, alt. 3400 m, on bark, 26/VI/1982, J.J. Su 2010 (HMAS-L 031687).

REMARKS: *Leptogium askotense* is characterized by the foliose thallus, the wrinkled upper surface, the tomentose and wrinkled thalline margin and stalks, and the euparaplectenchymatous proper exciple. It is reported from Himalayas of India (Awasthi & Akhtar 1977). Our specimens are morphologically similar to those reported from India and extend the species' range to SW China.

Leptogium trichophoroides P.M. Jørg. & A.K. Wallace resembles *L. askotense* in the tomentose, wrinkled thalline margin and the tomentose apothecial stalks, but differs by the darker upper surface and smaller spores (20–25 × 10–12 µm, Cao & al. 2012; 19–22 × 9–10 µm, Jørgensen 1997). *Leptogium delavayi* Hue is similar to *L. askotense* but has glabrous, swollen stalks and a glabrous thalline margin. *Leptogium arisanense* Asahina also resembles *L. askotense* but has sessile apothecia (Asahina 1936, Awasthi & Akhtar 1977, Wang & al. 2010).

Leptogium coralloideum (Meyen & Flot.) Vain.,
Ann. Acad. Sci. Fenn., Ser. A, 6(7): 110 (1915). Pl. 1B,C

Thallus foliose, irregular in outline, 6 cm in diam.; upper surface grayish blue when dry, glabrous, often striate and ridged, dull, isidiate; lobes round, horizontal near center, somewhat erect near margin, <5 mm wide, the margins entire to somewhat lacerate; isidia laminal, mostly on ridges, concolorous with the thallus or darker, not wrinkled, not apically collapsed, granular when young, cylindrical and coralloid when mature; lower surface paler, irregularly striate, with scattered tufts of white hairs.

Thallus homoiomerous, 100–200 μm thick; cortex on both sides consisting of a single layer of irregular, thin-walled cells of 5–7 μm in diam.; photobiont *Nostoc* cells in chains, embedded in a gelatinous layer.

Apothecia not seen.

On mosses.

Specimen examined: **China. Hunan Province**, Sangzhi County, Mt. Tianpingshan, 29°44′N 110°00′E, on moss, 19/VIII/1997, J.B. Chen & D.P. Wang 9606 (HMAS-L 031566).

Remarks: *Leptogium coralloideum* is characterized by the coralloid isidia distributed mainly along ridges on upper surface, and the lower surface with striates and few hairs. It is widely distributed worldwide, especially common in tropical and temperate regions (Aragon & al. 2005, Jørgensen & Nash 2004, Jørgensen 1994). The single specimen from China is morphologically similar to those reported outside the country.

Five coralloid–isidiate species—*Leptogium burnetiae* C.W. Dodge, *L. cyanescens* (Rabenh.) Körb., *L. laceroides* B. de Lesd., *L. lichenoides* (L.) Zahlbr. [≡ *Scytinium lichenoides* (L.) Otálora & al.], and *L. pseudopapillosum* P.M. Jørg.—have been reported in China (Jatta 1902, Wei 1991, Jørgensen 1997, Aptroot & al. 2002, Wang & al. 2010). Both *L. burnetiae* and *L. pseudopapillosum* differ from *L. coralloideum* by the dense, >100 μm long hairs covering the lower surface; *L. lichenoides* differs by its semi-erect to erect lobes and marginal isidia; *L. cyanescens* differs by its thinner lobes and upper surface without ridges; and *L. laceroides* differs by its smooth upper surface and dense hairs on lower surface.

Leptogium milligranum Sierk, Bryologist 67: 290 (1964). Pl. 1D

Thallus foliose, irregular in outline, 4 cm in diam.; upper surface gray-green when dry, glabrous, longitudinally wrinkled, isidiate; lobes irregular or somewhat indistinct, 2–8 mm wide, horizontal, often anastomosing, partly fenestrate, margin incised, occasionally with granular isidia; isidia

laminal, numerous, granular, simple, sometimes also cylindrical and slightly branched, glabrous, without wrinkles; LOWER SURFACE paler, with scattered tufts of white hairs.

THALLUS homoiomerous, 180–280 μm thick; CORTEX on both sides consisting of a single layer of subglobose, thin-walled cells of 4–7 μm in diam.; PHOTOBIONT *Nostoc* cells in chains, embedded in a gelatinous layer.

APOTHECIA not seen.

Corticolous.

SPECIMEN EXAMINED: **CHINA**. **YUNNAN PROVINCE**, Yimen County, 24°40′N 102°06′E, alt. 1980 m, on bark, 24/IX/2012, L.S. Wang & al. 12-35195 (KUN).

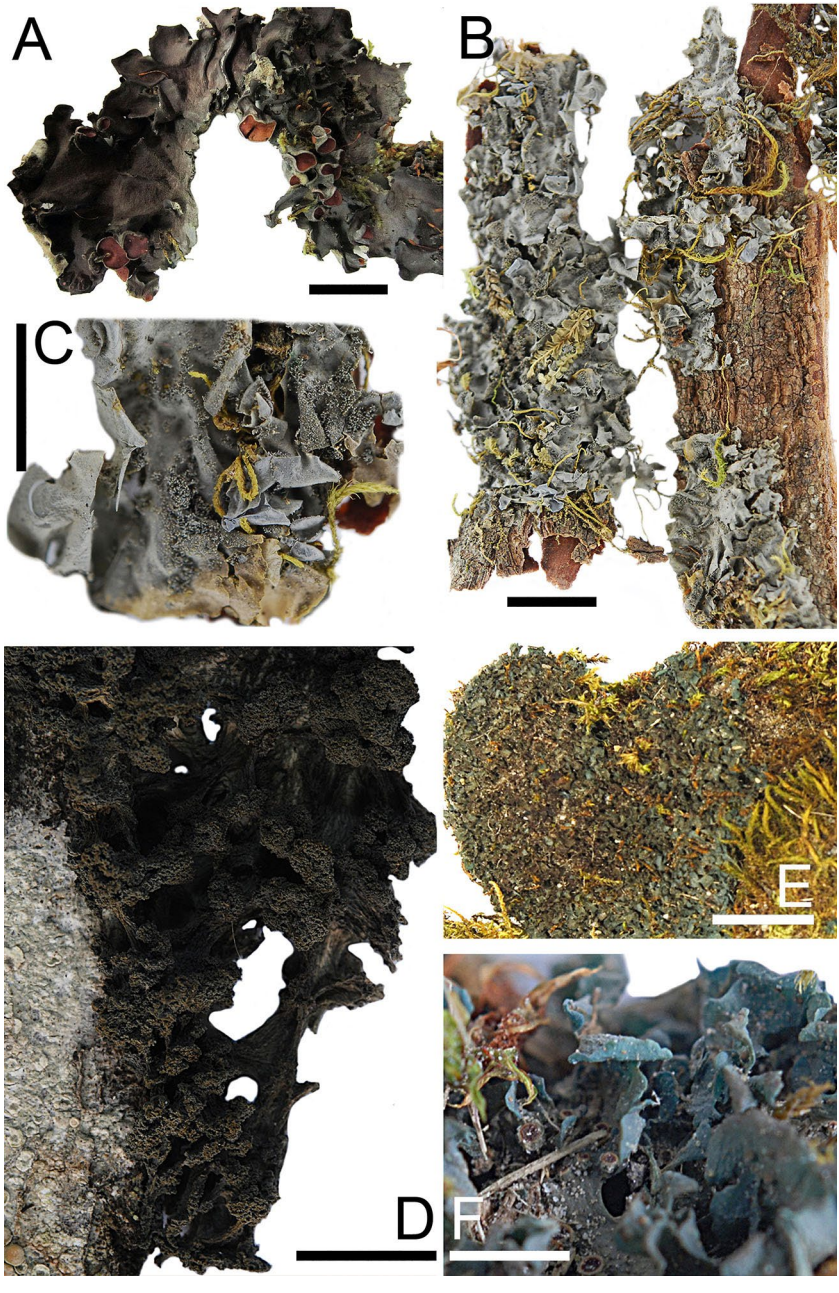
REMARKS: *Leptogium milligranum* is characterized by the green thallus, numerous granular isidia and wrinkles on upper surface, the indistinct, anastomosing lobes, and the sparsely rhizinate lower surface. Four granular–isidiate species—*L. asiaticum* P.M. Jørg., *L. papillosum* (B. de Lesd.) C.W. Dodge, *L. saturninum* (Dicks.) Nyl., and *L. weii* H.J. Liu & S. Guan—have been reported in China (Jatta 1902, Zahlbruckner 1930, Wang & al. 2010, Liu & Guan 2012), but they have distinct, round, non-anastomosing lobes.

Leptogium milligranum has been recorded from North America, Central America, Galápagos Islands, and India (Sierk 1964, Awasthi & Akhtar 1979, Jørgensen & Nash 2004, Bungartz 2008). Our specimen falls within the range of morphological variation of those reported from outside China.

Leptogium subtile (Schrad.) Torss., Enum. Lich. Byssac. Scandin.: 54 (1843). PL. 1E,F

THALLUS minutely foliose, partly forming a pulvinate cushion, irregularly in outline, <4 cm in diam.; UPPER SURFACE bluish when dry, glabrous, smooth, dull; LOBES dense, membranaceous, deeply dissected, 1–2 mm wide near center, <0.5 mm wide near margin, free to suberect at margin, entire; ISIDIA and LOBULES absent; LOWER SURFACE concolorous with upper surface, without wrinkles, with scattered tufts of white hairs. APOTHECIA scattered, laminal, sessile; disc red brown, 0.2–0.4 mm in diam., dull; THALLINE MARGIN persistent, concolorous with thallus or paler, glabrous, entire, without wrinkles and isidia.

PLATE 1. ***Leptogium askotense*** (KUN Wang 04-23160). A. Thallus with apothecia. ***Leptogium coralloideum*** (HMAS-L 031566). B. Thallus; C. Upper surface, showing isidia on ridges. ***Leptogium milligranum*** (KUN Wang 12-35195). D. Thallus, showing dense, granular isidia. ***Leptogium subtile*** (KUN Wang 05-24245). E. Thallus; F. Lobes and apothecia. Scale bars: A = 20 mm; B, D, E = 10 mm; C = 5 mm; F = 2 mm.


A
B
C
D
E
F

Thallus homoiomerous, 40–50 μm thick; cortex on both sides consisting of a single layer of subglobose to slightly irregular, thin-walled cells of 3–6 μm in diam.; photobiont *Nostoc* in chains. Apothecia lecanorine; epithecium yellowish to sometimes brown, about 10 μm thick; hymenium 100–150 μm thick; subhymenium 20–30 μm thick; proper exciple not seen; asci clavate, 8-spored; ascospores colourless, ellipsoid, obtuse at both ends, muriform, 4–6-septate transversely, 1–2-septate longitudinally, 20–30 × 10–12 μm.

On moss-covered barks.

Specimen examined: **CHINA**. **Yunnan Province**, Yuanyang County, Huangcaoling Town, 22°57′N 102°37′E, alt. 1200 m, on bark, 16/I/2005, L.S. Wang 05-24245 (KUN).

Remarks: *Leptogium subtile* is easily distinguished from other species in China by its minutely foliose and thin thallus, dissected, narrow and membranaceous lobes, smooth upper surface, and small, sessile apothecia. It was previously known from North America, Europe, and Asia (Jørgensen 1994, Kashiwadani & al. 2002, Jørgensen & Nash 2004, Aragón & al. 2005). It is rare in China with only one collection, which falls in the range of morphological variation of those from outside China.

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